AMENDMENT TO THE SPECIFICATION

Please, replace the paragraph on page 24, lines 3-9,

"In one embodiment of the present invention, FIG. 1 depicts an information flow chart 10 for the method of the present invention of steering a vehicle 28 along a predetermined 2-D path on a 2-D plane by using a steering control algorithm 16. In this embodiment of the present invention, the geometrical trajectory of the desired route (for instance, a trajectory Y=y (x; z = const) that defines a predetermined 2-D path) is input into the memory (not shown) of the navigation system 13 beforehand."

With the paragraph:

"In addition to using three magnetometers to measure three components of the local gravitational vector, in one embodiment of the present invention, the three components of the local gravitational vector can be measured by using the satellite technology.

Indeed, every star and planet generates a force, or field, of gravity. This force of attraction ensures that the Earth flies around the Sun and the Moon around the Earth. If the Earth were a perfect sphere, the gravitational force field around our planet would be completely symmetrical and would diminish uniformly in all directions away from it. However that is not the case.

On one hand, the rotation of the Earth creates a centrifugal force. It is strongest at the equator and diminishes to nothing at the poles. This centrifugal force pulls the planet apart so that it looks more like a rugby ball or an ellipsoid: The diameter at the equator is about 21 kilometers more than the diameter from pole to pole.

In addition, on a smaller scale, there are variations from the perfect ellipsoid, for instance from high mountains to deep sea trenches. This irregular topography leads to corresponding irregularities in the outer gravitational field. Moreover the interior of the Earth is not uniformly composed. There are zones of very dense and heavy rock where stronger terrestrial attraction prevails. In other locations, the crust material is lighter and the terrestrial magnetic field is less. Such so-called anomalies arise, for instance, where continental plates bump into one another or drift apart.

These irregularities in the structure of the Earth are directly mirrored in the structure of the gravitational field. Representing the field in spatial mapping, the Earth looks like a potato. A gravitational field atlas is as valuable for a geophysicist as a topographical map is for a surveyor. It contains a wealth of information.

From August 2006, the European research satellite GOCE will start "surfing" the Earth's gravitational field and investigate the interior of the planet from an altitude of about 250 kilometers. The Gravity-Field and Steady-State Ocean Circulation Explorer (GOCE) will circle the Earth for at least two years

and measure the gravitational field as well as the shape of the Earth more precisely than ever before. The data collected can then be used to study the structure of the Earth's interior and, at the same time facilitate in oceanographic investigations, like the measurement of the possible rise in the level of the ocean, or the analysis of ocean currents. EADS Astrium in Friedrichshafen is responsible for the construction of the satellite platform. Its engineers and scientists benefit from earlier satellite development, such as the environmental and climate satellite, CryoSat, currently being assembled in the clean room in Friedrichshafen. From the scientific standpoint, GOCE represents the extension of the CHAMP and GRACE missions, which also were created under the direction of EADS Astrium.

Satellites offer the only possible way to survey the entire gravitational force field of the Earth uniformly. This works as follows: the satellite circles the Earth in a fixed orbit where the gravitational force directed toward the Earth and the outwardly-directed centrifugal force are exactly in balance. In a perfectly symmetrical gravitational field the satellite would move in an elliptical or circular orbit, but if it passes over a "bump" or a "dent" in the gravitational field, then it experiences something similar to what a surfer faces in the ocean: It rides over a slightly wavy washboard. In the region of stronger gravitational force, it speeds up and climbs, whereas in a region of weaker gravitational force it slows down and drops. Following the path of the satellite exactly, the terrestrial gravitational field can be reconstructed from the orbital deviations.

Researchers have made giant strides in the past couple of years using the

CHAMP satellite (launched in July, 2000) and GRACE (launched in March, 2002). Both spacecraft were designed and manufactured under the leadership of EADS Astrium. GOCE will carry on the work of these two successful missions and deliver even more precise data. It should be able to measure details in the terrestrial gravitational field down to 70 kilometers, and variations in its strength down to a millionth of the average field.

The precision of these measurements can only be achieved with costly technology. Since the gravitational field weakens with the distance from the Earth, GOCE orbits at an altitude of only 250 kilometers. However at that altitude there is still a partial atmosphere and so to keep the resistance due to friction from the air to a minimum, the satellite was "streamlined". Its cross-sectional surface perpendicular to the direction of flight is only about a square meter. This was achieved by stretching out the body lengthwise and rigidly mounting the solar panels almost parallel to the direction of flight. In addition the satellite is almost symmetrical in shape.

Two technical conditions should be met so that the challenging plan can succeed. First, the orbit of the satellite should be followed exactly. This is achieved using a GPS receiver on the upper side of GOCE. The GPS makes it possible to determine the altitude of the satellite down to a centimeter. Secondly, variations in the orbit should be clearly traced back to irregularities in the terrestrial gravitational field. This is very difficult because, in spite of its streamlined shape, GOCE is very slightly slowed by the atmosphere. This negative acceleration is in the same order of magnitude as the gravitational

"dents."

However, there is a key difference between these two disturbances: If friction causes the satellite to drop, there is no equilibrium between the gravitational and centrifugal forces and the satellite accelerates. This effect is continually measured with three instruments, called gravimeters, perpendicularly positioned to each other. The onboard computer evaluates this data and directs an ion propulsion unit, which at a given moment delivers exactly the amount of thrust needed to compensate for the friction. In this way the satellite always stays in the same orbit. The remaining "surf-movements" are caused by the irregularities in the gravitational field which are just what the researchers want to measure. This procedure is called drag-free control.

Special demands are placed above all by the incredible orbital precision to which the satellite should adhere. Each force that may disturb the satellite should therefore be avoided. For instance the satellite structure should not be deformed by strong variations in temperature. These occur whenever GOCE emerges from the Earth shadows and flies into the sunshine, and vice versa.

In addition, the operation of relays and other moving parts during measurement phases is "verboten", because they exert undesirable forces on the satellite, which would disturb the measurements. This is no small task, given the multitude of devices which the EADS Astrium engineers have to install in the platform, including electronic controls for the solar generator, star sensor, solar sensor, Earth sensor, magnetometer and magnetic coils for the positional control,

as well as S-Band antennas and communication transponders.

EADS Astrium has several locations in Europe: (1) European Aeronautic Defense and Space Company EADS N.V. Le Carré, Beechavenue 130-132, 1119 PR Schiphol Rijk, The Netherlands; (2) EADS Deutschland GmbH, 81663 Munich, Germany; (3) EADS France S.A.S., 37, boulevard de Montmorency, 75781 Paris Cedex 16, France; (4) EADS CASA, Ava. de Aragón, 404, 28022 Madrid, Spain.

In one embodiment of the present invention, FIG. 1 depicts an information flow chart 10 for the method of the present invention of steering a vehicle 28 along a predetermined 2-D path on a 2-D plane by using a steering control algorithm 16. In this embodiment of the present invention, the geometrical trajectory of the desired route (for instance, a trajectory $Y=y$ (x; z = const) that defines a predetermined 2-D path) is input into the memory (not shown) of the navigation system 13 beforehand."

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Respectfully submitted,

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